

---

# CHAPTER 7

## ERGONOMICS

### EMPLOYEES AND THEIR WORK ENVIRONMENT

#### TABLE OF CONTENTS

7.00	INTRODUCTION
7.01	PURPOSE
7.02	POLICY STATEMENT
7.03	DEFINITIONS
7.04	WORKSITE EVALUATION
7.05	CONTROL INTERVENTIONS
7.06	WORK AREA DESIGN
7.07	WORKING HEIGHTS AND CHAIRS
7.08	LIGHTING
7.09	BACK CARE, SAFE LIFTING, AND BACK BELTS
7.10	WORKSTATION DESIGN ILLUSTRATIONS
	• ADJUSTING YOUR CHAIR AND WORKSTATION
	• PROPER BODY POSTURE
	• WORKSTATION LAYOUT

JULY 1996

ERGONOMICS

7-2

---

**ERGONOMICS**

**THIS SPACE AVAILABLE FOR NOTES:**

---

# CHAPTER 7

## **ERGONOMICS**

### **EMPLOYEES AND THEIR WORK ENVIRONMENT**

#### **7.00 INTRODUCTION**

“Ergonomics” is defined as the study of physical and behavioral interaction between humans and their environment.

This chapter discusses ergonomics in relation to the selection of furniture and equipment, position of the individual in relation to the work, arrangement of workstations, the proper use of video display terminals (VDT), and methods to reduce personal injury and occupational illnesses associated with computers.

#### **7.01 PURPOSE**

The purpose of this chapter is to introduce and promote an ergonomics program in which the work environment, including the position of tools, furniture and equipment, is compatible with the physical and behavioral limitations of the employee.

#### **NOTE:**

Please refer to the “Computer User’s Handbook” published by the Department of Personnel Administration (DPA), for supplemental information covering general industry safety guidelines that promote safe workstations for employees who work at computers.

#### **7.02 POLICY STATEMENT**

It is Caltrans policy to maintain an effective ergonomic program by selecting furniture and equipment, and arranging workstations, that will reduce health risks and personal injury in the workplace.

---

### 7.03 DEFINITIONS

1. **ADMINISTRATIVE CONTROLS** - Includes efforts to redesign workstations, adjustment of work space, changes in work assignments, changes in work schedules and work duties. It also includes limiting worker exposure, measuring performance, training, housekeeping, and maintenance.

2. **CUMULATIVE TRAUMA DISORDER (CTD)** - Any physical disorder that develops from or is aggravated by cumulative stress to tissues and joints. A Cumulative Trauma Disorder (CTD) is a personal injury caused by repetitive motion.

3. **CUMULATIVE TRAUMA DISORDER (CTD) RISK** - The presence of work activity factors such as:

Frequency - The rate at which specific physical motions or exertions are repeated.

Force - Physical exertion by or pressure applied to any part of the body.

Duration - The length of a period of work which poses a CTD risk.

Posture - The position of a body part during work activity.

Exposure - Exposure to localized or whole-body part, including hands and feet, to cold temperatures which cause discomfort.

4. **ENGINEERING CONTROLS** - Includes devices such as adjustable workstations, tables, chairs, equipment, keyboard, and tools; or physical modifications to workstations, equipment, tools, production processes.

5. **PERSONAL PROTECTIVE EQUIPMENT (PPE)** - Items worn on or attached to the body for protection; i. e., cloths, padding, gloves, devices, or equipment.

6. **VISUAL DISPLAY TERMINAL (VDT)** - Any device used or set of devices with keyboard and cathode ray tube or other electronic device for entry or display of data, words, numbers, and symbols.

7. **VDT OPERATOR** - An employee who routinely works at a VDT or any other aspect of the work.

---

## 7.04 WORKSITE EVALUATION

Each employee has unique anthropometric or physical characteristics: height, weight, reach, strength, sight, and hearing. A worker also brings individual work methods and style, such as lifting techniques, and some times unique ways of performing a task.

Worksite evaluation takes into consideration all of the anthropometric characteristics of an employee and attempts to match the employee to his/her work activity through the use of ergonomic principals.

The objective of worksite evaluation is to identify health risks in the workplace. Supervisors should look for work activities that are especially prone to CTD risk.

The following list includes some of the high risk activities that are likely to cause CTD and require evaluation:

1. Repeated use of the same tool or similar tools in activities.
2. Repetitive keystroking, which consists of manually striking or pressing a data-entry device such as a keypad or button.
3. Repetitive processing of items such as: assembly, cutting, trimming, packing, loading, mail handling, or auto repair.
4. Routine use of a mechanical or electronic device; e.g., chainsaw, hand drill, power tools.
5. The interval between repetitive motions and exertions, or between periods of repetitive activity, which is needed to prevent fatigue of the body parts performing the activity.
6. The presence of vibration while performing repetitive activity.
7. Exposure of fingers and toes to cold temperatures while performing repetitive activity.

Where repetitive activity is present, the high risk activities listed above can occur together. It is essential to identify each separately to ascertain which are the most hazardous and how each can be reduced.

Supervisor should initiate an inquiry into the employee's allegation whenever an employee discusses or reports that they are experiencing discomfort associated with his/her work, workstation, equipment, tool, new product, or new operation.

## **7.05 CONTROL INTERVENTIONS**

Control interventions are methods and strategies that can be introduced into the workplace, work activity, or process to reduce CTD risk.

Supervisors, with the assistance of the safety and health staff, should consider using control intervention whenever possible.

Engineering controls are aimed at eliminating the source of the ergonomic problem through engineering and design. Such factors as lowering or raising worktables, reorganizing the work process, and reducing hand forces can reduce CTD risk.

Administrative controls consist of early intervention in reviewing proper work practices, correctly matching workers to job demands, and other job considerations. The disadvantage of administrative controls is that they treat symptoms and not the cause of ergonomic problems.

Personal protective equipment for use in ergonomic situations is very limited. Splints, for example, shall not be used unless under the advice of a licensed physician or chiropractor. Other personal protective equipment used in ergonomic situations are back belts or lumbar supports. All of these items require approval by a licensed physician or chiropractor.

## **7.06 WORK AREA DESIGN**

Work areas should be based on body dimensions using the following principles:

- **HEAD HEIGHT:** allow for tallest worker and natural posture.
- **ELBOW HEIGHT:** adjust normal work surface to just below elbow height.
- **ARM REACH:** allow for shortest employee when reaching up or out; allow for tallest worker when reaching down.
- **LEG LENGTH:** allow for long legs; provide adjustment or footrests for shorter legs.
- **BODY BULK:** allow for largest worker, remember to consider varying girth and clothing bulk.

---

## 7.07 WORKING HEIGHTS AND CHAIRS

Working heights and chairs are the most common problems in workstation design.

The most favorable working height for handwork while standing is 2 to 4 inches below elbow level. On average, working heights of 37 to 39 inches will be convenient for men, and 35 to 37 inches for women. Besides these anthropometric considerations you also must allow for the nature of the work:

1. For delicate work; e.g., drawing, it is desirable to support the elbow.
2. For standing work, if it involves much effort and makes use of the upper part of the body; e.g., mailing/file handling, the working surface needs to be lowered to 6 inches to 16 inches below elbow height.

The following guidelines will help ensure the best match between chair and worker:

1. Office chairs must be adapted to both the traditional office job and the modern equipment at VDT workstations.
2. The chairs must accommodate both forward and reclined sitting postures.
3. The backrest should have an adjustable inclination and should be possible to lock the inclination at a desired position.
4. The backrest should have a well-formed lumbar support.
5. The seat surface (seat pan) should measure 15 to 18 inches across and 15 to 17 inches from back to front.
6. The chair must have adjustable height, swivel, rounded front edge, casters or glides, five-leg base, and user-friendly controls.

---

## 7.08 LIGHTING

Glare is the reflection on your VDT screen that makes it hard to see the screen clearly. Glare can be caused by sunlight on your screen, or by inside light, such as overhead and task lamps. Simple lighting adjustments can help minimize and reduce eyestrain and headaches.

- Position the screen so that it is at right angle to the window producing the glare.
- Close shades, curtains, or blinds, if necessary, as light changes during the day.
- Tilt the VDT screen down slightly to avoid overhead light from producing glare.
- Sit with ceiling lights at sides rather than directly overhead.
- If you use a task lamp, position it to aim the light at your document instead of your screen.
- To help improve your viewing comfort, you may also need to adjust your display screen's contrast and brightness moods.
- Periodically clean your screen to maximize clarity. Font characters on the screen should be clear, stable, and free from perceptive flicker.
- Consider attaching a glare shield to the VDT screen if you are unable to eliminate the glare by other means.



---

## **7.09 BACK CARE, SAFE LIFTING, AND BACK BELTS (LUMBAR SUPPORT)**

Lifting is the most common task associated with low-back injuries. Back injuries are caused from overexertion, either sudden or cumulative. Improper lifting causes low-back injury, while repeated trauma to the arms and hands - shoulder to fingers cause CTD. The most effective means of minimizing back injuries is through training on proper lifting techniques.

The following techniques should help reduce the risk of low-back injury:

### **BEFORE YOU LIFT**

- Always warm up before you lift any load to prevent muscle strains and pulls.
- Stretch your back with upward reaches and continue to loosen tight muscles with simple side and back bends.

### **LIFTING SAFELY**

- Use mechanical assistance whenever possible.
- Roll, push, or pull the object to its destination.
- Redesign the task to eliminate lift.
- Let your abdomen, legs, and buttocks do the work.
- Get close to the load. Grab the load safely with your hands placed under the object.
- Bend your knees, with feet slightly spread, for balance and stability.
- Keep your head, shoulders, and hips in a straight line as you lift.
- Do not twist.
- Reverse these steps when you set a load down. Move slowly and smoothly without twisting.
- To change direction of carry, do not twist. This is crucial when doing repetitive lifting. Turn your entire body, including your feet.
- Never lift from a sitting position. Sitting puts more pressure on the spine. Stand before you lift.
- Push rather than pull a load.
- When the object is too heavy for one person to lift, admit it, then get help.

### **KEEP THE PATH CLEAR**

- Look at the move before you lift and clear the path you plan to follow.
- If you can't see over the load, don't carry it.
- Use mechanical help (pushcart, handtruck, wheelbarrow) if the load is heavy or bulky.
- Know where the load/item is to be placed.

NOTE:

It is Departmental policy that back belts shall not be purchased as personal protective equipment.

**SPECIAL NOTE ABOUT BACK BELTS:**

The National Institute for Occupational Safety and Health (NIOSH) does not recommend the use of back belts to prevent injuries among uninjured workers, and does not consider back belts to be personal protective equipment. NIOSH further concludes that there is insufficient data indicating that typical back belts significantly reduce the biomechanical loading of the body (trunk) during manual lifting.

Also, there is insufficient scientific evidence to conclude that wearing back belts reduces risk of injury to the back based on changes in abdominal pressure and trunk muscles, and the use of back belts may produce temporary strain on the cardiovascular system.

Back belts may be purchased only for employees who have a doctor's prescription specifically indicating that the employee should use a back belt for specific work activities.

**7.10 WORKSTATION DESIGN ILLUSTRATIONS**

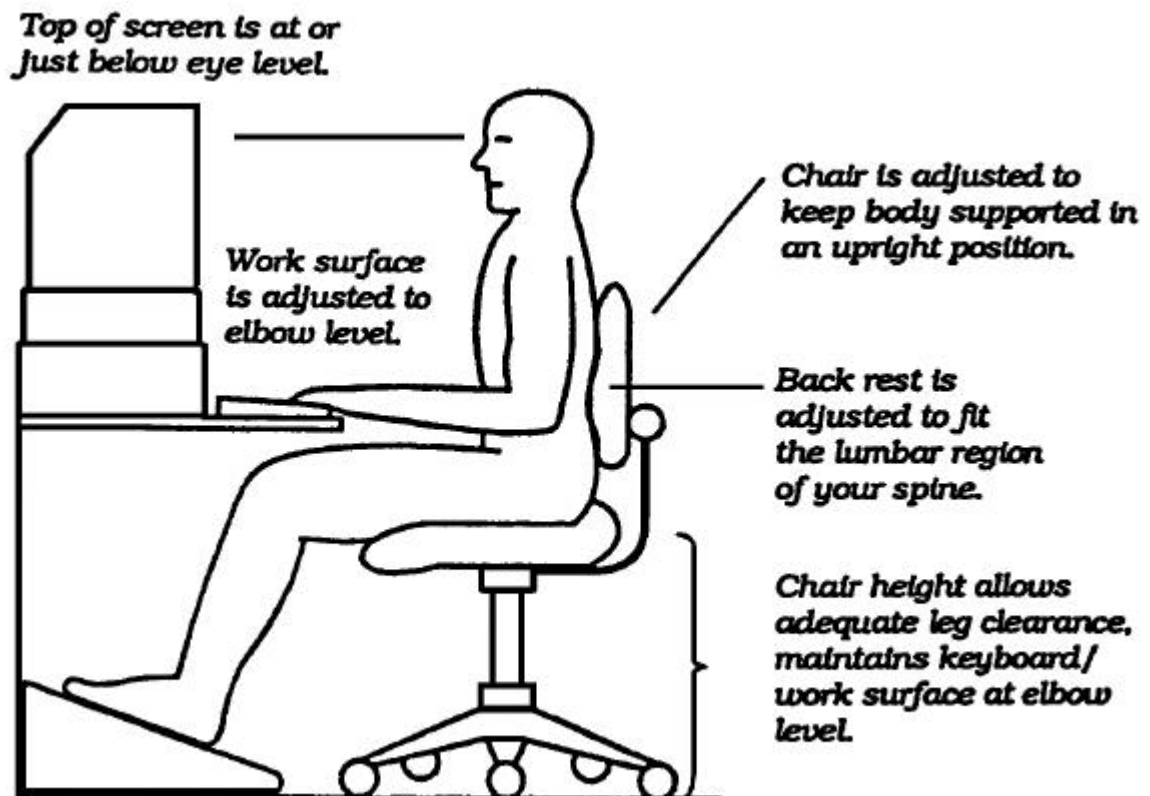
The following workstation design illustrations represent guidelines that promote safe workstations for employees who work at video display terminals (VDT). These illustrations cover most of the principals of ergonomics necessary for workstation design and personal comfort.

Proper VDT use, including proper posture and workstation adjustments with careful attention to muscle and eye fatigue, will help prevent musculoskeletal and visual problems.

---

**ADJUSTING YOUR CHAIR AND WORKSTATION**

- Adjust lumbar (lower back) support by moving the back rest up or down to match the inward curve of your spine.
- Adjust the tilt of the back rest and/or seat to keep your body supported in an upright position.
- Adjust the seat height for adequate leg clearance under the workstation and keep the keyboard at approximately elbow level.
- Adjust your monitor so that the top of the screen is at or just below eye level and is a viewing distance of between 18" and 24".
- Use a document holder that places the documents at the same height as the monitor.

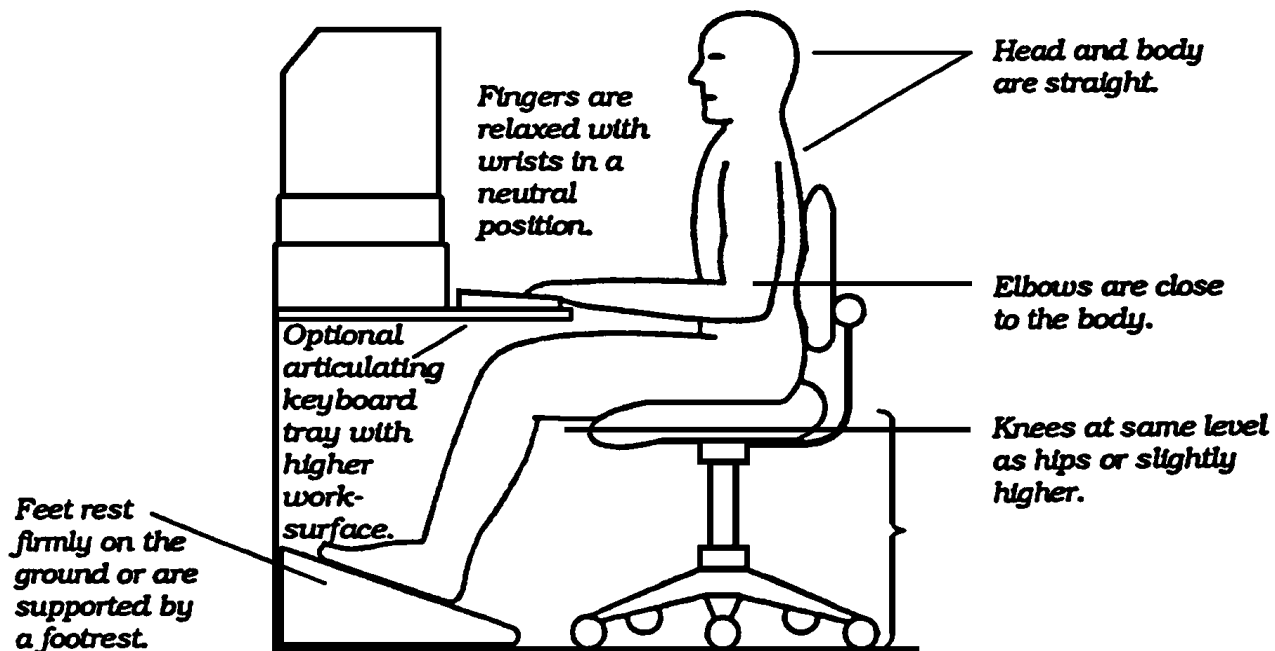


Note: Reassess your workstation periodically.

---

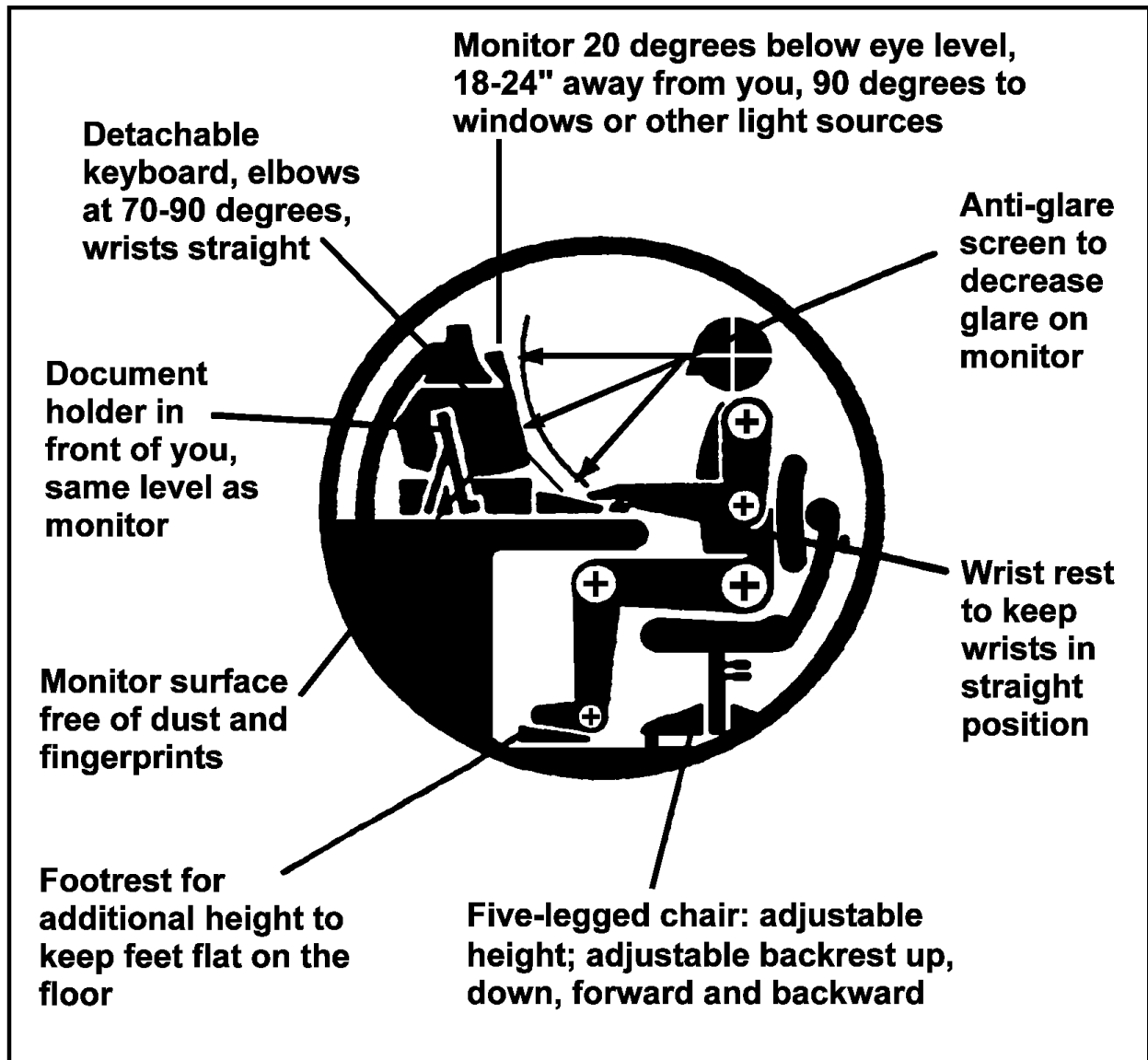
**PROPER BODY POSTURE**

- Keep your head in line with your shoulders and hips
- Keep elbows close to your body
- Keep wrists in a neutral position; bent no more than 10° up or down
- Keep your knees at the same level as your hips or slightly higher
- Keep feet flat on the floor or supported by a footrest
- A keyboard tray for fixed work surfaces and padded wrist rests can be used to help support the wrists in a neutral position
- Keep fingers in a relaxed position when working
- Avoid extreme finger extensions



Note: Reassess your body posture periodically.

---

**WORKSTATION LAYOUT**

JULY 1996

ERGONOMICS

7-14

---

**ERGONOMICS**

**THIS SPACE AVAILABLE FOR NOTES:**